Claims

1. A casing member for a WDM add/drop multiplexer unit, the casing member comprising:

- a backplane for interconnection of components of the WDM add/drop multiplexer unit inserted in the casing member, and

- at least one heat sink opening formed in a wall of the casing member disposed to, in use, receive a heat sink structure of a component of the WDM add/drop multiplexer unit in a manner such that the heat sink structure is exposed to an ambient around the casing member when the component is mounted in the casing member, for facilitating maintaining a controlled temperature environment inside of the component.

2. A casing member as claimed in claim 1, wherein the heat sink opening is formed in the backwall incorporating the backplane.

3. A casing member as claimed in claim 2, wherein a pair of heat sink openings is formed in a mirrored configuration on either side of the backplane with respect to a centreplane halfway along the width of the casing member.

4. A casing member as claimed in claim 3, wherein the casing member further comprises a first key member arranged, in use, to prevent a component of the WDM add/drop multiplexer unit from contacting the backplane, when said component is inserted upside down in its intended slot, or when it is inserted in another component's intended slot, and wherein the first key member is adapted to cooperate with a heat sink structure of said component.

5. A casing member as claimed in claims 3 or 4, wherein the casing member further comprises a second key member arranged, in use, to prevent a component of the WDM add/drop multiplexer unit from contacting the backplane, when said component is inserted upside down in another component's intended slot, and wherein the second key member is adapted to co-operate with a third key member formed on said component.

6. A casing member as claimed in claims 1 or 2, wherein the casing member further comprises at least one vent opening in one wall of the casing member.

7. A casing member as claimed in claim 6, wherein the casing member comprises at least one pair of vent openings, the openings of the pair being formed in opposite walls of the casing member.

8. A casing member as claimed in claim 7, wherein the at least one pair of vent openings is formed in th sidewalls of the housing.

9. A casing member as claimed in claim 7, wherein at least one pair of vent openings is formed in the top and bottom walls of the housing element.

10. A casing member as claimed in claim 1, wherein the housing element is adapted for mounting onto a rack structure.

11. A casing member as claimed in claim 1, wherein the housing element is adapted to be mounted horizontally or vertically.

12. A casing member as claimed in claim 1, wherein the casing member further comprises a heat sink unit mounted onto the casing member and adapted, in use, when components of the WDM add/drop multiplexer unit are inserted in the casing member, to make thermal contact with at least one of the components, for facilitating maintaining a controlled temperature environment inside of said component.

13. A casing member as claimed in claim 12, wherein the heat sink unit is arranged in a manner such that, in use, the interconnection to said component is releasable.

14. A casing member as claimed in claims 12 or 13, wherein the heat sink unit is incorporated in the backwall incorporating the backplane.

15. A casing member as claimed in claim 14, wherein the heat sink unit is formed on the backplane.

16. A casing member as claimed in claim 12, wherein the heat sink unit comprises a plurality of substantially planar fins disposed substantially parallel to the backwall of the casing member, and mounted by way of at least one longitudinal mounting member expanding substantially perpendicularly from the backwall. Accordingly, convection airflow between the fins is preferably not inhibited in either a horizontal or a vertical mounting position of the casing member.

17. A casing member as claimed in claim 1, wherein the casing element further comprises at least one fan device mounted on the outside of the housing element and disposed in a manner such that, in use when the heat sink structure of the component of the WDM add/drop multiplexer unit extends through the heat sink opening of the housing element, the heat sink structure is subjected to an airflow generated by the fan device.

18. A casing member as claimed in claim 1, wherein the casing member further comprises at least one baffle structure externally mounted or formed on the casing member, and arranged in a manner such that in use when the casing member is mounted vertically into the rack structure, convection airflow from one heat sink structure or heat sink unit is diverted away from other heat sink structures or heat sink units.

19. A chassis member for carrying at least one circuit board, wherein the chassis member is adapted, in use, to function as a heatsink for a heat generating component mounted on the circuit board.

20. A chassis member as claimed in claim 19, wherein a main body of the chassis is contoured or shaped in a manner such that, in use, a distance between the heat generating component and a region of the main body facing the heat generating component is reduced compared to other components on the circuit board.

21. A chassis member as claimed in claims 19 or 20, wherein the chassis member comprises sidewalls formed around the peripheral region of the main body and adapted to function, in use, as at least a portion of housing sidewalls of a housing structure for the circuit board.

22. A chassis member as claimed in claim 19, wherein the chassis member is adapted, in use, to carry at least one circuit board above and at least one circuit board below of the main body.

23. A WDM multiplexer module comprising:

- a housing,

- a chassis member located substantially inside the housing and adapted to function as a heat sink,

- a heat sink structure extending from the housing and in thermal communication with the chassis member,

- a first thermoelectric (TE) device in thermal communication with the chassis member,

- at least one heat generating electrical component in thermal communication with the chassis member, and

- a control unit arranged, in use, to maintain a controlled temperature environment inside the housing utilising the heat sink structure, the TE device, and the heat generating electrical component and utilising the chassis member as a thermal communication medium.

24. A module as claimed in claim 23, wherein the module further comprises

- a local thermal environment structure located inside the housing and

- a second TE device in thermal communication with the chassis member and the local thermal environment structure,

whereby, in use, a second stage controlled temperature environment is created substantially inside the local thermal environment structure, and

wherein temperature variations in the second stage controlled temperature environment are smaller than temperature variations inside the housing.

25. A module as claimed in claims 23 or 24, wherein the module comprises at least one laser source disposed in a manner such that, in use, the source temperature of the laser source is substantially governed by the second stage controlled temperature environment.

26. A module as claimed in claim 25, wherein the laser source is a semiconductor laser source, and a junction of the laser source is located substantially inside the local thermal environment structure.

27. A module as claimed in claim 26, wherein a laser driver associated with the laser source is located substantially outside the local thermal environment structure, whereby the thermal environment around the laser driver is governed by the controlled temperature environment inside the housing.

28. A module as claimed in claim 23, wherein the module comprises a plurality of electrical components, and the control unit is further arranged, in use during start-up or re-start of the module, to sequentially switch on the electrical components based on operating temperature specifications and heat generating characteristics of the electrical components to facilitate creation of the controlled temperature environment.

29. A module as claimed in claims 23 or 24, wherein the heat sink structure comprises at least one heat pipe.

30. A module as claimed in claim 29, wherein the heat pipe has a working fluid characterised by a freezing temperature above -40°C, whereby a discontinuity in heat transfer to and from the heat sink structure is created for temperatures below the freezing temperature of the working fluid in the heat pipe for reducing heat loss from the inside of the housing.

31. A module as claimed in claim 30, wherein the freezing temperature is about zero °C.

32. A module as claimed in claims 23 or 24, wherein the chassis member comprises side walls formed around the peripheral region of a main body of the chassis member, and said side walls form at least a portion of housing side walls of the housing.

33. A module as claimed in claims 23 or 24, wherein the housing is adapted to function as an electro-magnetic induction (EMI) shield.

34. A module as claimed in claims 23 or 24, wherein the module further comprises a first key member arranged, in use, to cooperate with a second key member formed on a casing member into which the module is inserted, to prevent the module from making contact with a backplane of the casing member when the module is inserted upside down into a slot of the casing member for which the module is not intended.

35. A method of thermal control of a WDM multiplexer module, the method comprising the steps of:

- maintaining a first stage controlled temperature environment inside the module and

- maintaining a second stage controlled temperature environment in at least a portion of the inside of the module,

wherein temperature variations in the second stage controlled temperature environment are smaller than temperature variations of the first stage controlled temperature environment.

36. A method as claimed in claim 35, wherein the module comprises at least one laser source, and the source temperature of the laser source is substantially governed by the second stage controlled temperature environment.

37. A method as claimed in claims 35 or 36, wherein the module comprises a plurality of electrical components, and the method further comprises, during start-up or re-start of the module, the step of sequentially switching on the electrical components based on

operating temperature specifications and heat generating characteristics of the electrical components to facilitate creation of the first stage controlled temperature environment.

38. A method as claimed in claims 35 or 36, wherein the maintaining of the first and second stage controlled temperature environments comprises utilising at least one heat pipe.

39. A method as claimed in claim 38, wherein the heat pipe has a working fluid characterised by a freezing temperature above -40°C, whereby a discontinuity in heat transfer to and from the heat sink structure is created for temperatures below the freezing temperature of the working fluid in the heat pipe for reducing heat loss from the inside of the housing.

40. A method as claimed in claim 39, wherein the freezing temperature is about zero °C.

41. An optical network node incorporating a casing member for a WDM add/drop multiplexer unit as claimed in claims 1 or 2.

42. An optical network node incorporating a chassis member for carrying at least one circuit board as claimed in claims 19 or 20.

43. An optical network node incorporating a WDM multiplexer module as claimed in claims 23 or 24.

44. An optical network incorporating an optical network node as claimed in claim 41.

45. An optical network incorporating an optical network node as claimed in claim 42.

46. An optical network incorporating an optical network node as claimed in claim 43.